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Hydraulic fracturing has been proven as an efficient method to improve recovery from unconventional reservoirs and also a potential method for improving the sweep in the North Sea chalk reservoirs. While the majority of the published research focus on a single (or multiple) fracture(s) in a homogenous, single layer rock, it is evident that the real reservoirs are consisted of multiple, soft and stiff layers, which makes the hydraulic fracturing process more complex (Figure 1). When a hydraulic fracture hits an interface, it can be arrested at the interface, or the new layer can act as a favourable medium for the fracture to grow in. In this study, hydraulic fracturing process through multiple layers is investigated using a robust finite element code, CSMP. Different layers in the model have different mechanical properties, thus the stress distribution is not continuous across interfaces and that discontinuity affects the growth direction and the size of the hydraulic fracture in each layer. The hydraulic fractures are assumed to propagate under toughness regime, so the fracture toughness of each layer is also affecting the propagation direction and the shape of the induced fracture. A sensitivity analysis on the governing parameters is performed and the results are presented. The outcomes of this research can be instrumental in designing the hydraulic fractures in the chalk reservoirs in the Danish North Sea.

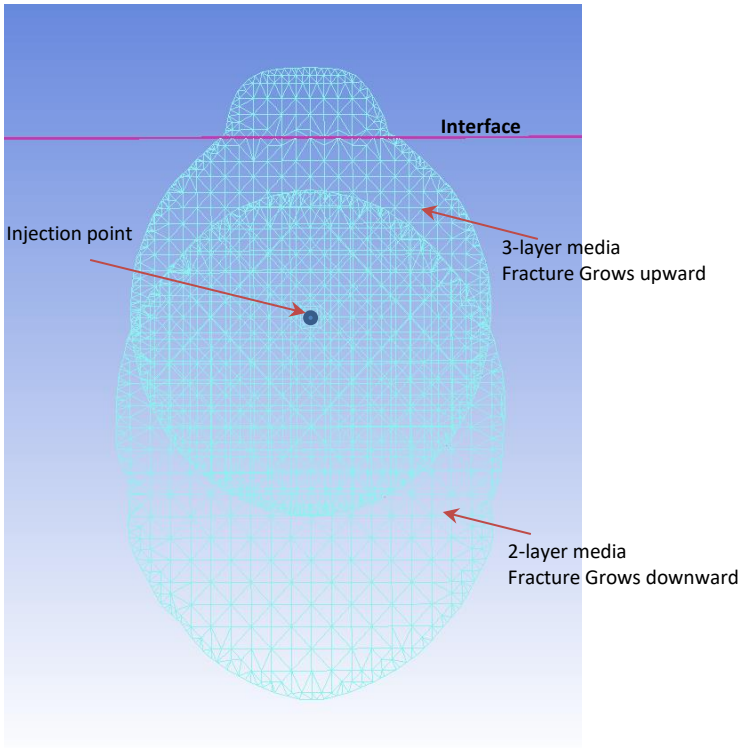

Figure 1- The shape of the hydraulic fracture is affected by the layers' thickness